

14. On a small Collection of Vertebrate Remains from the Har Dalam Cavern, Malta; with Note on a new species of the genus *Cygnus*. By DOROTHEA M. A. BATE, Hon.M.B.O.U.*

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The researches of Spratt and Leith Adams, and later those of Dr. Cooke and Mr. Tagliaferro, on the extinct fauna of the Pleistocene cave-deposits and fissures of Malta have already yielded a rich harvest. The excavations of the two former extended over a long period. Dr. Leith Adams, for instance, spent six years in the island, a great part of this time being devoted to investigating its cave and fissure deposits †. That there is still scope for yet further research is shown by a collection lately sent for examination to the British Museum (Nat. Hist.) by the Curator of the Malta Museum. This task was very kindly entrusted to the present writer by Dr. A. Smith Woodward, F.R.S.

The literature dealing with the subject is very scattered, and the records extend over a great number of years. Therefore, before making a few observations suggested by a study of this collection, it has been thought useful to workers on the palæontology of the Mediterranean Region to give as complete a list as possible of the vertebrates of which remains have been obtained from the Pleistocene of Malta. Leith Adams published a similar list in 1877 ‡, but this contains a record of only twenty-one species, although *Elephas falconeri* and *Myoxus cartei* are included. It is gratifying to find that this number has since been nearly doubled, although no extensive systematic excavations have been carried on.

LIST OF SPECIES.

MAMMALIA.

1. *Ursus arctos* (?) Linn.
2. *Vulpes* sp.
3. *Canis* sp. (size of *C. lupus*).
4. *Leithia melitensis* Leith Adams sp.

* Communicated by Dr. A. SMITH WOODWARD, F.R.S., V.P.Z.S.

† Nat. Hist. & Archaeol. of Nile Valley and Maltese Islands, Edinburgh, 1870.

‡ Quart. Journ. Geol. Soc. vol. xxxiii. 1877, pp. 177-190.—“On gigantic land-tortoises . . . from the Ossiferous Caverns of Malta . . . together with a list of their fossil fauna.”

5. *Eliomys* sp.
6. *Arvicola amphibius* Linn.
7. „ *pratensis* Baillon.
8. *Equus* sp.
9. *Cervus dama* (?) Linn.
10. „ *elaphus* var. *barbarus* Bennet.
11. *Hippopotamus pentlandi* Meyer.
12. „ *melitensis* Forsyth Major.
13. *Elephas mnaidriensis* Leith Adams.
14. „ *melitensis* Falconer.

AVES.

15. *Strix melitensis* Lydekker.*
16. *Eutolmætus fasciatus* Vieill. sp.
17. *Cypis melitensis* Lydekker. †
18. *Anser* sp.
19. *Branta leucopsis* Bechst. sp.
20. „ *bernicla* Linn. sp.
21. *Cygnus falconeri* Parker.
22. „ *musicus* Bechst.
23. „ *equitum*, sp. n.
24. „ sp.
25. *Anas* sp.
26. *Marmaronetta angustirostris* Ménétr. sp.
27. *Columba melitensis* Lydekker.*
28. *Grus melitensis* Lydekker. †
29. *Otis tardu* Linn. sp.
30. *Tetrao* sp.

REPTILIA AND BATRACHIA.

31. *Testudo robusta* Leith Adams.
32. „ *spratti* Leith Adams.
33. „ *robustissima* Tagliaferro.
34. *Lutremys europea* Gray.
35. *Lacerta* sp.
36. Batrachia undetermined.

Besides the above, remains of several domesticated species have been recorded by Dr. Smith Woodward from the Har Dalam Cavern, from which rude pottery has also been obtained in some quantity ‡.

I have omitted from my list both *Elephas falconeri* of Busk and *Myoxus carteri* of Leith Adams. The specimens described under the former name seem hardly sufficiently distinct to be separated from *E. melitensis*, to which species they were referred by Lydekker. The same author also pointed out that

* Cat. Foss. Birds in Brit. Mus. 1891, pp. 13, 124.

† Proc. Zool. Soc. 1890, pp. 404, 408.

‡ See Ashby, Zammit & Despott in 'Man,' Jan. & Feb. 1916, vol. xvi. Nos. 1 & 2.

M. cartei was evidently a synonym of *Leithia melitensis*; he further showed that the mandibular ramus figured by Leith Adams as that of a young specimen of *Leithia* is undoubtedly that of an *Eliomys*.

The occurrence of *Arvicola amphibius* and *A. pratensis* is given on the authority of Leith Adams, and I do not know if any specimens have been preserved. It ought to be mentioned that Dr. Caruana reported having found a portion of a lower jaw of a *Hyæna* in the island of Gozo.

So far as I am aware no thorough investigation has been made of the present-day mammalian fauna of the island, but it would seem to be but poorly represented in species, for Sir John Murray enumerates the indigenous mammalia as follows:—"The rabbit, weasel, hedgehog, Norway rat, species of mice, and bats" *.

I should like to take this opportunity of recording my grateful thanks to Dr. A. Smith Woodward, F.R.S., to Dr. C. W. Andrews, F.R.S., and to Mr. W. P. Pycraft, for kind help and for giving me every facility for studying the remains of fossil and recent birds in the National Collection.

The Remains from the Har Dalam Cavern.

The small collection under notice was obtained from the Har Dalam Cavern, and the adherent matrix shows that the specimens were embedded in a layer of red cave-earth. They are rather fragmentary, but a comparatively large number of species are represented and range from a small *Elephas* to the extinct rodent *Leithia*. Most numerous of all are the avian remains, which include those of a hitherto undescribed swan and several other species not previously recorded as occurring in a fossil condition in the island. It will be remembered that Dr. Cooke had already carried out some investigations in this cave, the chief results of which have been described by him and Dr. Smith Woodward †.

MAMMALIA.

Of mammals, there are examples of four species only, two of which call for no special notice here, for *Elephas melitensis* is represented by a scaphoid only, and *Cervus elephus barbarus* by a metatarsus and a phalanx. The remaining two are *Leithia melitensis* and a small species of *Equus*, the specimens of which each show some points of interest.

Leithia.—A small number of rather fragmentary remains of *Leithia* are included in the collection. A few of these agree in size with the larger corresponding specimens in the British Museum Collection, but the others are so very much larger that they almost suggest the existence of a second species, though it behoves one to be careful with regard to size alone

* Scottish Geog. Mag. vol. vi. 1890, p. 453.

† Proc. Roy. Soc. vol. liv. 1893, pp. 274-283.

as a character, more especially when dealing with island forms, if island form this be.

One specimen shows very distinctly the distal joining of the tibia and fibula which, according to Weber*, is an important character distinguishing the Myomorpha from the Sciuromorpha in which these two bones are only joined proximally. Lydekker †, on the other hand, attached little weight to this point, although admitting that a distal union is unknown among living Sciuromorphs. Unfortunately, there is not yet sufficient material available to settle definitely the question of the systematic position of the genus, though the latter author was probably correct in suggesting that *Leithia* constituted a separate family, Leithiidae. This view is strengthened by the fact that two further species of *Leithia*, not yet described, have been discovered by the writer in the cave-deposits of the Balearic Islands. This greatly extends the known range of the genus, which is, no doubt, another representative of the "Tyrrhenian" fauna preserved in the Pleistocene deposits of the islands of the western Mediterranean region.

Through the courtesy of Mr. J. Wilfrid Jackson I have been able to examine an imperfect left mandibular ramus of a small species of fox from the Pleistocene of Malta, belonging to the collection of the Manchester Museum. So far as I am aware, no fox is found in the island at the present day, and still further interest is given to this specimen in that this occurrence of a small carnivore for which *Leithia* would appear to be a suitable prey, suggests that the abundance and tendency towards an increase in size in the rodent can only be explained by the theory that it was at any rate more or less arboreal in habit. That it was not highly specialised for a fossorial mode of life is shown by the shape of the skull and the curvature of the incisors ‡.

Equus.—Finds of *Equus*-remains in the Pleistocene cave and fissure deposits of Malta have been very few up to the present, and, so far as I am aware, none has been recorded from the other islands of the Mediterranean, though their occurrence in the Genista Cave, Gibraltar, has been noted by Dr. Hugh Falconer in his list of species from that locality §. Further work in this region will probably yield other finds of a similar kind.

The present collection includes a left upper pm. 2, which is believed to be that of a small horse, for its crown pattern shows the small enamel-fold described as fold 5 ("pli caballin") by Prof. H. F. Osborn, who considers its presence a means of distinguishing molars of *E. caballus* from those of *E. asinus* ||. It indicates an animal of about the size of a New Forest pony. The greatest

* 'Die Säugethiere,' Jena, 1904, p. 489.

† Proc. Zool. Soc. 1895, p. 862, footnote.

‡ I am indebted to Mr. M. A. C. Hinton for information kindly given me on this point.

§ Pal. Mem. vol. ii. p. 555, London 1868.

|| Osborn, H. F., "The continuous origin of certain unit characters as observed by a Palaeontologist," Harvey Lectures, Ser. 1911-12, pp. 200-1, fig. 8.

height of the specimen is 63 mm., the antero-posterior width 30 mm., and the thickness 21 mm. Perhaps its chief interest lies in its association with remains of one of the small elephants and those of a large chelonian, thus showing definitely for the first time the contemporaneity of the *Equus*-remains with the rest of the extinct Pleistocene fauna of the island. For Leith Adams wrote that he had no evidence of such a contemporaneity; and, further, an imperfect metacarpus, previously obtained from the Har Dalam Cavern, was found in a superficial layer, and included with remains of man, domestic animals, and rude pottery*. This last example, now in the British Museum Collection, consists of the proximal half only of the metacarpus, the greatest diameter of the articular surface being 38 mm.; it is a somewhat stouter bone than one in the collection of the Manchester Museum. Mr. J. Wilfrid Jackson has made some interesting notes on this last specimen which he very kindly placed at my disposal, and which I feel I cannot do better than quote in full:—

“The Manchester Museum possesses a short and extremely slender adult metacarpal bone of an Equine which was found many years ago in one of the Malta caves associated with remains of *Cervus barbarus*, fox and tortoise. In length the bone measures 160 mm., whilst the width at the middle of the shaft is only 20·7 mm. (index 7·72). The width of the distal end = 29 mm.

“The slenderness of the bone is very remarkable. According to Prof. J. C. Ewart (Proc. Roy. Soc. Edin. xxx. pt. 4, 1910, p. 291), the cannon bones in fossil and recent Asiatic wild asses are long and slender, the length of the metacarpal being at least eight times the width at the middle of the shaft. The index of the Malta bone is 7·72, and therefore suggestive of ass rather than horse, as in the latter the index is never more than 7·5.

“However, assuming it to belong to horse, it would indicate an animal of about 10 hands in height (according to Ewart, *op. cit.* p. 297, footnote), *i. e.* slightly higher than a typical Shetland pony. In a specimen of the latter with a height of 36·5 ins. the metacarpals measured 143 × 25 mm. (*vide* Ewart).

“I believe the British Museum possesses a metacarpal from Auvergne (? Pleistocene) which measures 173 × 24 mm. (index 7·20), which would indicate a slender-limbed animal under 11 hands at the withers.

“Prof. Ewart writes me that he has also a record of a 156 × 25 mm. metacarpal from Seine Inférieure, which means a horse about 9·2 hands.”

AVES.

Owing to its geographical position Malta receives many visitors on migration, which accounts for the large number of recent

* Proc. Royal Soc. vol. liv. 1893, p. 281.

species recorded from the island, which nowadays has only a very small indigenous avifauna. Numerous lists of these have been published; the latest and most complete is one which appeared only last year (1915), and was compiled for the Malta University Museum of Natural History by M. Giuseppe Despott, Curator of that Institution. This brings the record down to December 1914, and contains about 50 species not included in previous lists, while the total comes to over 300.

As might be expected, avian remains from Malta are far less plentiful than those of associated mammals, and an exact determination is often further hampered by the fragmentary condition of many of the specimens, and occasionally by lack of recent material for comparison. It seems most probable that the birds whose remains occur in the cavern deposits were, at least partially, resident in the island. It is not surprising to find species represented that nowadays only occur accidentally or on migration, for the whole character of the extinct Pleistocene fauna of the island shows that the climate, vegetation, and probably the extent of the land surface, were very different from those obtaining at the present day. The fact that anserine birds, including several extinct species, are so largely represented leads one to suppose that they flourished when there were considerable tracts of low-lying and marsh lands, probably before the final submergence of the land (part of which is now known as the Medina Bank) which connected Malta with Sicily and formed a northern extension of the present Tripolitan coast-line.

The present collection includes the distal half of a humerus believed to be that of the Brent Goose (*Branta bernicla*), for it only differs from recent specimens with which it has been compared in being very slightly larger. Other limb-bones appear to be those of the Barnacle Goose (*B. leucopsis*). The former species has already been somewhat doubtfully recorded from Malta, while the writer has obtained remains of the latter from a Pleistocene fissure in Menorca; at the present day these geese occur very sparingly in the Mediterranean, and probably then only on migration.

Remains of several species of Swans have already been obtained from the Maltese cave-deposits, including the very large extinct form, *Cygnus falconeri*, described by Parker*. Of this bird he wrote (p. 123) that it "was rather generalized in character, being somewhat of a goose, possessing as he did longer legs and shorter toes than the typical swans. It would appear, however, that this bird had its wings of the full relative size: the immense ulna shows this." Later, he suggests that "perhaps he was altogether more terrestrial," but I think this was meant as opposed to swimming habits and did not refer to any loss of power of flight. The same author (*loc. cit.*) also described and figured some specimens believed to represent *C. musicus*, at the

* Trans. Zool. Soc. vol. vi. pp. 119-124, pl. xxx.

same time suggesting the possibility of there having been remains of more than these two species of swan in the Zebbug Cave.

A few specimens in the British Museum Collection are said by Lydekker* to "indicate a swan of considerably smaller size than *C. musicus*." None of the remains in the present collection agrees with these last, and only one phalanx is somewhat doubtfully referred to *C. falconeri*. A left femur wanting the inner condyle agrees very closely in size and form with the corresponding bone of *C. musicus* (Brit. Mus. 449 d), and there seems little doubt that it ought to be referred to this species, which has already been recorded from Malta both in a fossil state and as an accidental visitor during severe winters.

The present collection from the Har Dalam Cavern includes a few remains of an anserine bird, believed to be a small swan, which it has been impossible to identify with the corresponding bones of any of the species with which I have been able to compare them, either from Malta or among the recent skeletons in the osteological collection of the British Museum. With the small amount of material available it cannot be said definitely that these specimens all represent a single species, but it is believed that this is so at any rate in the case of a proximal portion of a left humerus, a right coracoid, and a right metacarpus. Besides these, the proximal portions of two ulnæ and perhaps a radius might also be included. It is suggested that this species be known as

CYGNUS EQUITUM, sp. n.

Right metacarpus (text-fig. 1).—It is proposed to take this specimen as the type. It is in a good state of preservation, but has the distal extremity abraded and the central portion of the third metacarpal is absent. It is peculiarly interesting on account of its being relatively very much shorter and stouter than the corresponding bone of any recent species of swan or goose with which I have been able to compare it. This character seems to indicate without much doubt that it belonged to a bird in which the power of flight was already considerably reduced.

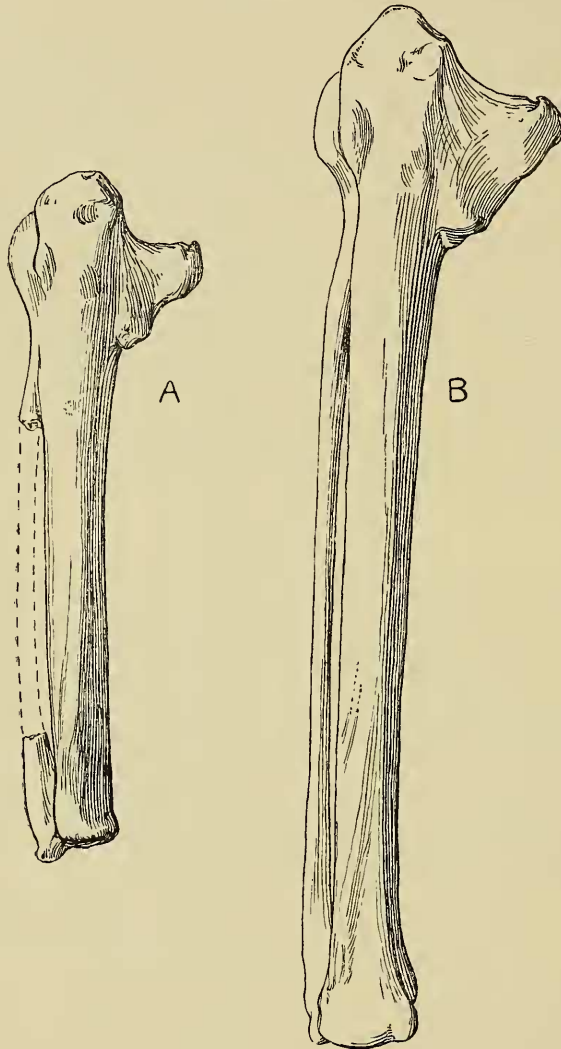
The following measurements, given in millimetres, will show the comparative size of this bone in the Maltese bird, in two recent species of swan, and in *Tachyeres*.

	<i>C. equitum.</i>	<i>C. musicus.</i>	<i>C. olor.</i>	<i>Tachyeres.</i>
Greatest length of metacarpus	90	139	137	61
Greatest diameter of shaft of second metacarpal	8	10.5	10	6
Greatest thickness of proximal articulation	11	13	11	8

* Cat. Foss. Birds in Brit. Mus. 1891, p. 110.

It will be seen from the above that the relative proportions of this bone in *C. equitum* and *Tachyeres* are not very different, which suggests that, as in the latter, *C. equitum* might have

Text-figure 1.



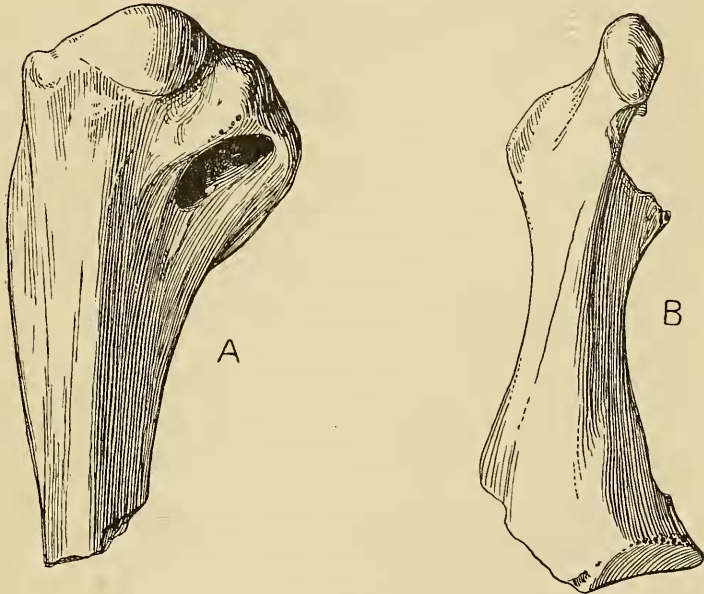
A. Right metacarpus of *Cygnus equitum*.
B. Right metacarpus of *C. musicus*.

Both natural size.

lost its power of flight only when the bird attained its full size and weight. In *Tachyeres* the young are said to be able to fly*.

In the large extinct *Cnemiornis calcitrans* it is not only this bone which had been enormously reduced but likewise the other bones of the wing, while the keel of the sternum had almost completely disappeared; whereas in *Tachyeres*, although there is already some reduction in the size of the ulna and radius, the sternum appears to be normal.

Text-figure 2.



A. Proximal portion of left humerus of *Cygnus equitum*.

B. Right coracoid of *C. equitum*.

Both natural size.

Compared with that of *C. olor*, the metacarpus from Malta is relatively a very much shorter and stouter bone; also the third metacarpal is separated from the second for a comparatively much shorter distance, causing the articular ends to be more massive. The first metacarpal is in keeping with the rest of the bone, being large and stout. The proximal articular surface is much flatter than in either *C. olor* or *C. musicus* owing to the pre-axial border being less raised. The comparative proportions of this bone perhaps approach, on the whole, more nearly to those of *C. musicus*, which, judging from the skeletons which

* Owen, "On *Cnemiornis*," Trans. Zool. Soc. vol. ix. 1875, p. 266.

I have examined, appears to be a stouter-limbed bird than *C. olor*.

Humerus (text-fig. 2 A).—The proximal portion of a left humerus believed to belong to the same species as the above metacarpus shows a similar characteristic stoutness of build, and is unlike any specimen with which it has been compared. It is actually very much smaller, but in comparative proportions agrees fairly closely with the corresponding portion of the humerus of *C. musicus*, except that the general outline is squarer and the head and trochanter are stouter, while the subtrochanteric fossa is more definitely defined and much deeper, and the groove separating the head and the trochanter is more deeply excavated.

Coracoid (text-fig. 2 B).—A right coracoid is also believed to be that of *C. equitum*, being of corresponding size and showing the same general characteristics as the two bones described above. This specimen is in a good state of preservation, only wanting the outer portion of its sternal border and the point of the subclavicular process. In comparative proportions it is not unlike the corresponding bone of *C. musicus*, although its ventral aspect is rather different owing to the wider base from which the subclavicular process springs and the greater thickness of the ridge between the head and the main body of the bone. The surfaces of contact with the sternum are wide and shallow.

Ulna.—The collection includes the proximal portions of a right and left ulna, which I have been unable to identify with any recent specimens to which I have had access. They appear to agree in size and robustness with the limb-bones described above and are provisionally ascribed to the same species. Their dorsal aspects show no roughened surfaces for the attachment of the flight-feathers.

Radius.—The distal portion of a radius with about two-thirds of the shaft is more doubtfully assigned to this species, as it is perhaps comparatively rather larger than the two ulnæ.

Two species of Bustards are represented in the collection by a few fragmentary remains. Both these species occasionally occur as stragglers to the island at the present day, but neither has been previously recorded in a fossil state.

The distal portion of a right tibio-tarsus and the proximal portion of a left scapula are referred to *Tetrax campestris*, while the distal extremities of two tarso-metatarsi are ascribed to *Otis tarda*, one being that of a male and the other that of a female bird.